

CLAIMS

What is claimed is:

1. A low dielectric constant material, comprising:

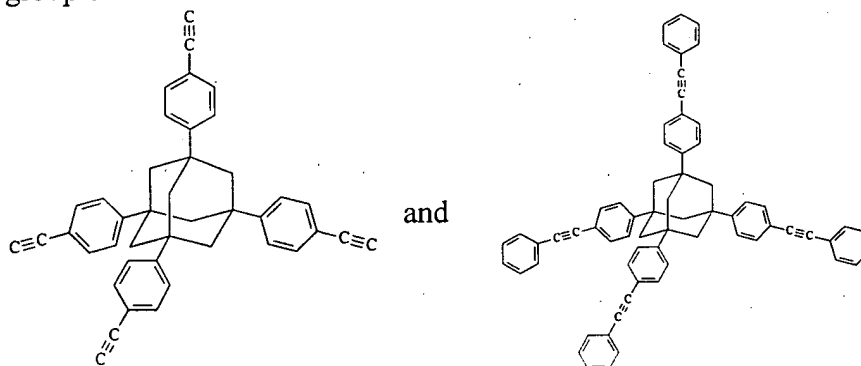
a polymeric network that is fabricated from at least a first component and a second component;

wherein the first component comprises a polymeric strand;

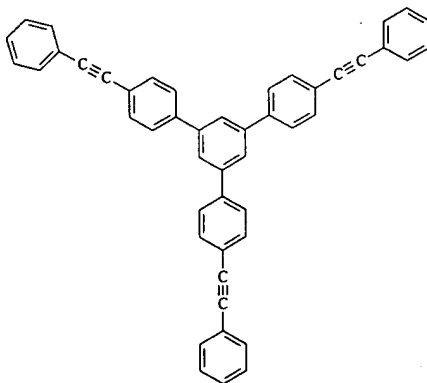
wherein the second component comprises a molecule having a central portion with at least three arms extending from the central portion, wherein each of the arms includes a backbone having a reactive group; and

wherein the first component and the second component form the polymeric network in a reaction involving at least one of the reactive groups when the first and second components are thermally activated.
2. The low dielectric constant material of claim 1 wherein the polymeric strand comprises a poly(arylene).
3. The low dielectric constant material of claim 2 wherein the poly(arylene) is selected from the group consisting of a poly(arylene ether), a poly(arylene ether-ether-ketone), a poly(arylene ether-quinoxaline), a poly(arylene ether-benzil), and a poly(arylene ether-quinoline).
4. The low dielectric constant material of claim 1, wherein the polymeric strand comprises a polymer selected from the group consisting of a polyimide, a polyamide, a polyimide-amide.
5. The low dielectric constant material of claim 1 wherein the central portion of the molecule comprises a cage compound.
6. The low dielectric constant material of claim 5, wherein the cage compound is selected from the group consisting of an adamantane, a diamantane and a fullerene.

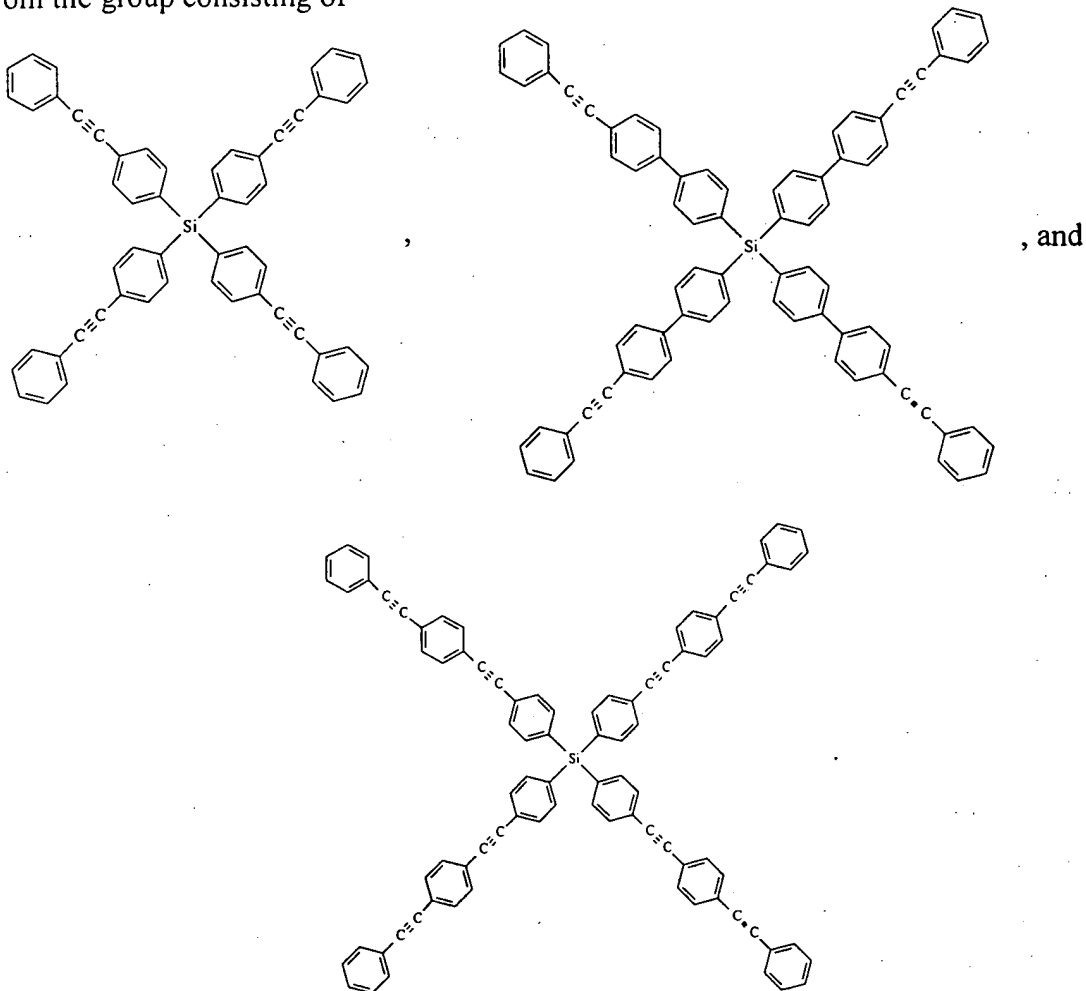
7. The low dielectric constant material of claim 1 wherein the central portion of the molecule comprises a silicon atom.
8. The low dielectric constant material of claim 1 wherein at least one of the three arms of the molecule comprises an aromatic ring.
9. The low dielectric constant material of claim 8 wherein the at least one of the three arms further comprises an ethynyl group.
10. The low dielectric constant material of claim 9 wherein the at least one of the three arms comprises a chemical group selected from the group consisting of a 4-ethynylphenyl, a tolanyl, a 4-phenylethynylbiphenyl, and a bistolanyl.
11. The low dielectric constant material of claim 1 wherein the molecule has a structure selected from the group of



12. The low dielectric constant material of claim 1 wherein the molecule has the structure



13. The low dielectric constant material of claim 1 wherein the molecule has a structure selected from the group consisting of



14. The low dielectric constant material of claim 1 wherein the reactive group is a triple bond.
15. The low dielectric constant material of claim 1 wherein the polymeric network is a semi-interpenetrating network.
16. The low dielectric constant material of claim 1 wherein the reaction comprises a cyclo-addition reaction.

17. The low dielectric constant material of claim 1 wherein the reaction takes place without an additional crosslinking molecule.
18. The low dielectric constant material of claim 1 wherein the thermal activation comprises heating the first and second components to a temperature of at least 200°C.
19. The low dielectric constant material of claim 1 wherein the low dielectric constant material has a dielectric constant of less than 2.4.
20. The low dielectric constant material of claim 1 wherein the low dielectric constant material has a dielectric constant of less than 2.7.
21. The low dielectric constant material of claim 1 wherein the material has a glass transition temperature higher than 400°C.
22. The low dielectric constant material of claim 1 wherein the material has a glass transition temperature higher than 450°C.
23. A method of forming a low dielectric constant material, comprising:

providing a first component that comprises a polymeric strand;

providing a second component that comprises a molecule having a central portion with at least three arms extending from the central portion, wherein each of the arms includes a backbone having a reactive group; and

forming a polymeric network from at least the first component and the second component, wherein the first component and the second component form the polymeric network in a reaction involving at least one of the reactive groups when the first and second components are thermally activated.

24. The method of claim 23 wherein the polymeric strand comprises a poly(arylene), and wherein the central portion is selected from the group consisting of an adamantane, a diamantane, a fullerene, and a silicon atom.